Charter School Performance in Massachusetts

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CREDO at Stanford University

434 Galvez Mall
Stanford University
Stanford, CA 94305-6010

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Acknowledgements

This report, *Charter School Performance in Massachusetts*, is part of a larger set of studies on charter school effectiveness that CREDO is conducting. CREDO gratefully acknowledges the support of the Walton Family Foundation for supporting this portion of the research. All results and opinions expressed in this report, however, belong to CREDO.

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Introduction

Across the country, charter schools occupy a growing position in the public education landscape. Heated debate has accompanied their existence since their start in Minnesota two decades ago. Similar debate has occurred in Massachusetts as well, with charter advocates extolling such benefits of the sector as expanding parental choice and introducing market-based competition to education. Little of that debate, however, is grounded in hard evidence about their impact on student outcomes. This report contributes to the discussion by providing evidence for charter students' performance in Massachusetts for six years of schooling, beginning with the 2005-2006 school year and concluding in 2010-2011.

With the cooperation of the Massachusetts Department of Education, CREDO obtained the historical sets of student-level administrative records. The support of Massachusetts DOE staff was critical to CREDO's understanding of the character and quality of the data we received. However, it bears mention that the entirety of interactions with the Department dealt with technical issues related to the data. CREDO has developed the findings and conclusions independently.

This report provides an in-depth examination of the results for charter schools in Massachusetts. It is also an update to CREDO's first analysis of the performance of Massachusetts's charter schools, which can be found at our website.[1] This report has three main benefits. First, it provides an updated rigorous and independent view of the performance of the state's charter schools. Second, the study design is consistent with CREDO's reports on charter school performance in other locations, making the results amenable to being benchmarked against those nationally and in other states. Third, the study includes a section on charter performance in the Boston area, where much attention has focused.

The analysis presented here takes two forms. We first present the findings about the effects of charter schools on student academic performance. These results are expressed in terms of the academic progress that a typical student in Massachusetts would realize from a year of enrollment in a charter school. The second set of findings is presented at the school level. Because schools are the instruments on which the legislation and public policy works, it is important to understand the range of performance for the schools. These findings look at the performance of students by school and present school average results.

[1] CREDO. *Charter School Performance in Massachusetts* (2009). http://credo.stanford.edu

Compared to the educational gains that charter students would have had in a traditional public school (TPS), the analysis shows on average that students in Massachusetts charter schools make larger learning gains in both reading and mathematics. At the school level, 44 percent of the charter schools have significantly more positive learning gains than their TPS counterparts in reading, while 13 percent of charter schools have significantly lower learning gains. In math, 56 percent of the charter schools studied outperform their TPS peers and 17 percent perform worse.

The impact of charter schools in Boston are also analyzed separately. Compared to the educational gains that charter students would have had in TPS, the analysis shows on average that students in Boston charter schools have significantly larger learning gains in both reading and mathematics. In fact, the average growth rate of Boston charter students in math and reading is the largest CREDO has seen in any city or state thus far. At the school level, 83 percent of the charter schools have significantly more positive learning gains than their TPS counterparts in reading and math, while no Boston charter schools have significantly lower learning gains.

Study Approach

This study of charter schools in Massachusetts focuses on the academic progress of their enrolled students. Whatever else charter schools may provide their students, their contributions to their students' readiness for secondary education, high school graduation and post-secondary life remains of paramount importance. Indeed, if charter schools do not succeed in forging strong academic futures for their students, other outcomes of interest, such as character development or non-cognitive skills, cannot compensate. Furthermore, current data limitations prevent the inclusion of non-academic outcomes in this analysis.

This statewide analysis uses the Virtual Control Record (VCR) methodology that has been used in previous CREDO publications.[2] The approach is a quasi-experimental study design with matched student records that are followed over time. The current analysis begins with the general question of whether in the aggregate students in Massachusetts charter schools outperform their TPS counterparts. This general question is then extended to consider whether the observed charter school performance is consistent when the charter school population is disaggregated along a number of dimensions, such as race/ethnicity, geographic location and so on. Answers to all these questions require that we ensure that the contribution of the schools – either the charter schools or the TPS schools – is isolated from other potentially confounding influences. For this reason, these analyses include an array of other variables whose purpose is to prevent the estimate of charter schooling to be tainted by other effects. In its most basic form, the analysis included controls for student characteristics: standardized starting score, race/ethnicity, special education and lunch program participation, English proficiency, grade level, and repeating a grade.

To create a reliable comparison group for our study, we attempted to build a VCR for each charter school student. A VCR is a synthesis of the actual academic experience of students who are identical to the charter school students, except for the fact that they attend a TPS that the charter school students would have attended if not enrolled in their charter school. We refer to the VCR as a 'virtual twin' because it takes the experience of multiple 'twins' and creates a single synthesis of their academic performance to use as the counterfactual to the charter school student's performance.

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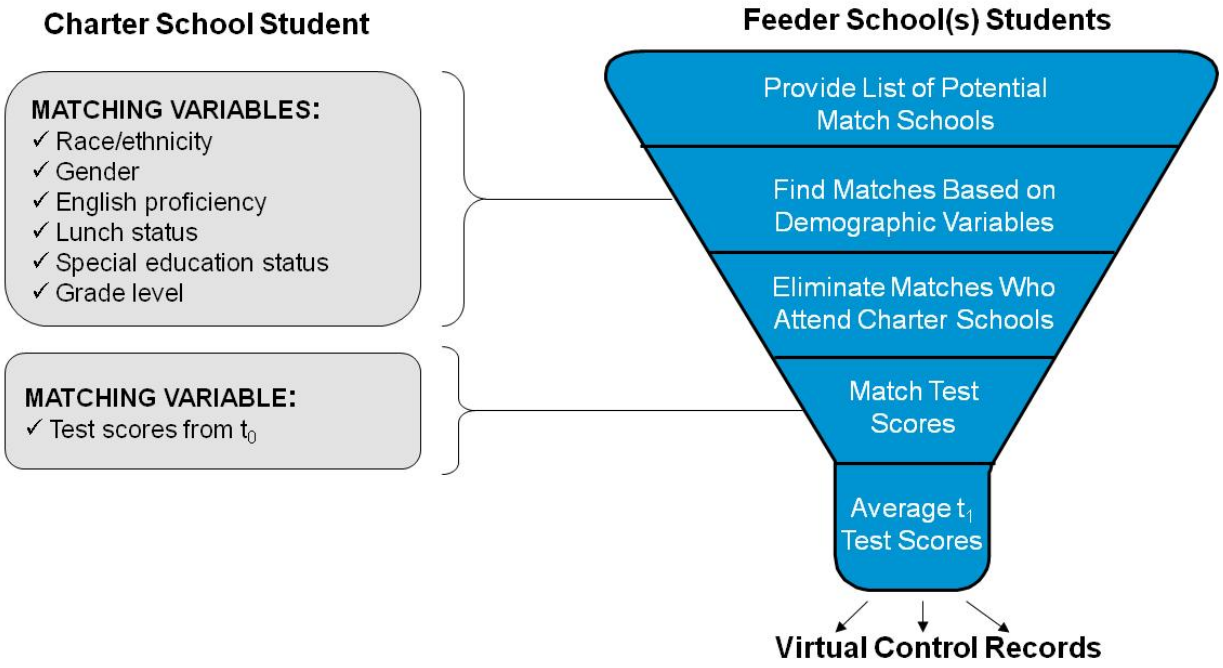
[2] CREDO. *Multiple Choice: Charter School Performance in 16 States* (2009). Davis, Devora H. and Margaret E. Raymond. Choices for Studying Choice: Assessing Charter School Effectiveness Using Two Quasi-experimental Methods. *Economics of Education Review* 31, no. 2 (2012): 225-236. For the interested reader, links to these reports are available at http://credo.stanford.edu.

Our approach is displayed in Figure 1. We identify all the traditional public schools whose students transfer to a given charter school; each of these schools is a "feeder school." Once a TPS qualifies as a feeder school, all the students in the school become potential matches for a student in a particular charter school. All the student records from all the feeder schools are pooled – this becomes the source of records for creating the virtual match. Using the records of the students in those schools in the year prior to the test year of interest (t_0), CREDO selects all of the available TPS students that match each charter school student.

Match factors include:

- Grade-level
- Gender
- Race/Ethnicity
- Free or Reduced Price Lunch Status
- English Language Learner Status
- Special Education Status
- Prior test score on state achievement tests

Figure 1: CREDO Virtual Control Record Methodology



At the point of selection as a VCR-eligible TPS student, all candidates are identical to the individual charter school student on all observable characteristics, including prior academic achievement. The focus then moves to the subsequent year, t_1. The

scores from this test year of interest (t_1) for as many as seven VCR-eligible TPS students are then averaged and a Virtual Control Record is produced. The VCR produces a score for the test year of interest that corresponds to the expected gains a charter student would have realized if he or she had attended one of the traditional public schools that would have enrolled the charter school's students. The VCR provides the counterfactual "control" experience for this analysis.

For the purposes of this report, the impact of charter schools on student academic performance is estimated in terms of academic growth from one school year to the next. This increment of academic progress is referred to by policy makers and researchers as a “growth score” or “learning gains” or ”gain scores.” Using statistical analysis, it is possible to isolate the contributions of schools from other social or programmatic influences on a student's growth. Thus, all the findings that follow are measured as the average one-year growth of charter schools, relative to the VCR-based comparison.

With six years of student records in Massachusetts, it is possible to create five periods of academic growth. One growth period needs a "starting score", (i.e., the achievement test result from the spring of one year) and a "subsequent score," (i.e., the test score from the following spring) to create a growth score. To simplify the presentation of results, each growth period is referred to by the year in which the second spring test score is obtained. For example, the growth period denoted "2008" covers academic growth that occurred between the end of the 2006-2007 and the end of the 2007-2008 school years. Similarly, the time period denoted "2011" corresponds to the year of growth between the 2009-2010 and 2010-2011 school years.

With six years of data, and seven tested grades (3rd - 8th, 10th), there are 41 different sets of data each for Reading and Math (missing 10th grade in 2005-2006); each subject-grade-year group of scores has slightly different mid-point averages and distributions. The analysis is aided by transforming the test scores for all these separate tests into a common measurement. All test scores have been converted to "bell curve" standardized scores so that year-to-year computations of growth can be made.[3]

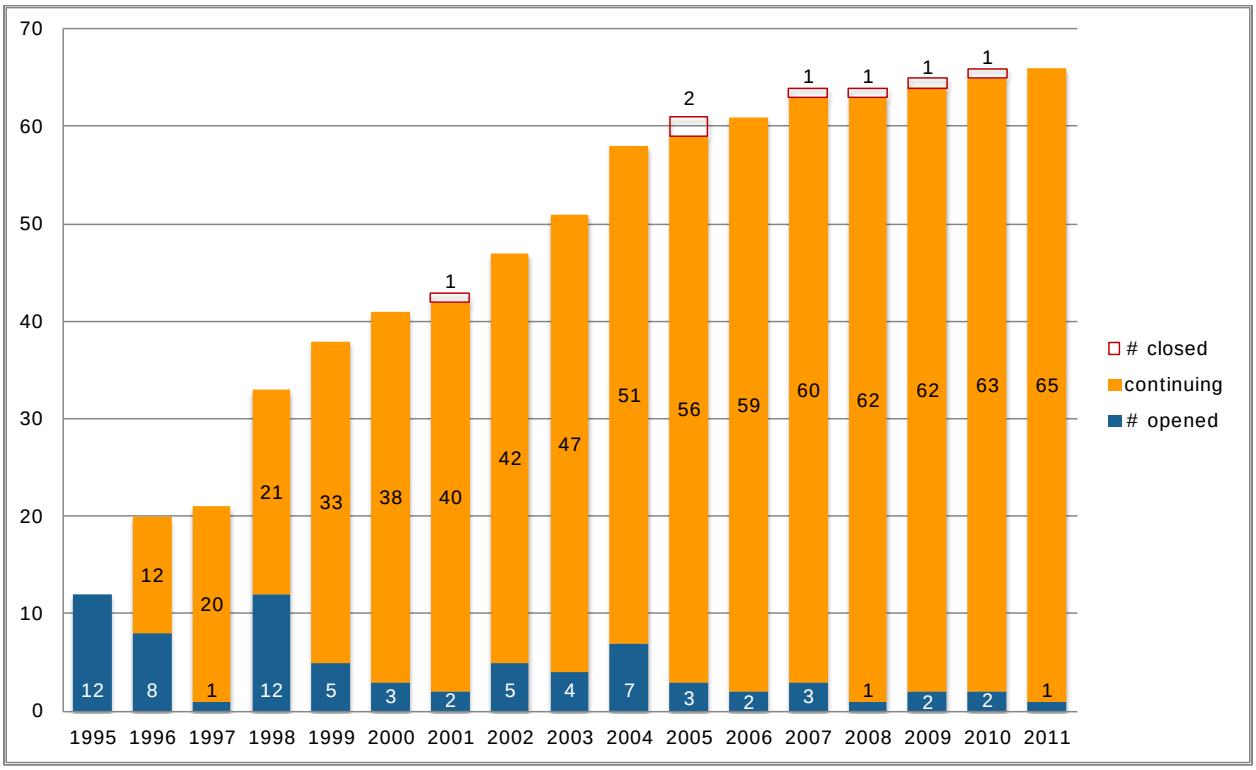
[3] For each subject-grade-year set of scores, scores are centered around a standardized midpoint of zero, which corresponds to the actual average score of the test before transformation. Then each score of the original test is recast as a measure of deviation around that new score of zero, so that scores that fell below the original average score are expressed as negative numbers and those that were larger are given positive values. These new values are assigned so that in every subject-grade-year test, 68 percent of the former scores fall within a given distance, known as the standard deviation.

When scores are thus standardized into z-scores, every student is placed relative to his peers in his own state. A z-score of zero, for example, denotes a student at the 50th percentile in that state, while a z-score one standard deviation above that equates to the 84th percentile. Students who maintain their relative place from year to year would have a growth score of zero, while students who make larger gains relative to their peers will have positive growth scores. Conversely, students who make smaller academic gains than their peers will have negative growth scores in that year.

Massachusetts Charter School Demographics

The Massachusetts charter school sector has grown markedly since its inception in 1995. Figure 2 below notes the new, continuing and closed charter school campuses from the fall of 1995 to the fall of 2011.

Figure 2: Opened and Closed Charter Campuses, 1995-2011



According to the National Center for Education Statistics (NCES), there were 63 charter schools open in Massachusetts in the 2010-2011 school year.[4] Because charter schools are able to choose their location, the demographics of the charter sector may not mirror that of the TPS sector as a whole. Further, charter schools create a degree of sorting through their offer of different academic programs and alternate school models. In addition, parents and students who choose to attend charter schools select schools for a variety of reasons, such as location, school safety, small school size, academic focus or special interest programs. The cumulative result of all these forces is that the student populations at charters and their TPS feeders may differ. Table 1 below compares the student populations of all Massachusetts's traditional public schools, the charters' feeder schools, and the charter schools themselves.

Table 1: Demographic Comparison of Students in TPS, Feeders and Charters

	TPS	Feeders	Charters
Number of schools	1773	566	63
Average enrollment per school	524	488	436
Total number of students enrolled	929,569	276,123	27,484
Boston Students	6%	12%	13%
Students in Poverty	33%	46%	47%
English Language Learners	6%	10%	4%
Special Education Students	16%	17%	12%
White Students	70%	58%	43%
Black Students	8%	12%	26%
Hispanic Students	15%	21%	23%
Asian/Pacific Islander Students	5%	6%	5%
Native American Students	0.3%	0.3%	0.3%

Table 1 above shows that charter schools have more students in poverty, more Black and Hispanic students and significantly fewer White students than the public school population of Massachusetts as a whole. The feeder school populations would be expected to more closely align demographically and they do, but even here there are differences. Charter schools enroll greater shares of Black students, and a smaller share of White students and English Language Learners compared to the feeder schools. Feeder schools and charter schools have roughly the same proportions of students living in poverty.

There has been considerable attention paid to the share of students in charter schools who are receiving Special Education services or who are English Language

[4] This is the most recent year available from the NCES Common Core of Data Public School Universe.

Learners. As shown in Table 1, a lower proportion of Massachusetts's charter school population is designated as special education compared to all TPS, and this proportion is also lower than that of the feeder TPS population. The cause of this difference is unknown. Parents of children with special needs may believe the TPS sector is better equipped to educate their children and therefore will be less likely to opt out for a charter. An alternate possibility is that charter schools and traditional public schools have different criteria for making referrals for assessment or categorizing students as needing special education.

The profile for English Language Learners also shows that, in the aggregate, charter schools enroll a smaller share than the feeder schools, and roughly the same as found statewide in TPS. As with Special Education students, it is not possible to discern the underlying causes for these figures.

Table 2: Demographic Composition of Charter Students in the Study

Student Group	All Charter Students Tested		Matched Charter Students	
	Number	Percent	Number	Percent
Massachusetts Charter Students	30,692		25,473	
% Matched	25,473	83%		
Black Students	7,225	24%	5,359	21%
Hispanic Students	6,456	21%	4,980	20%
White Students	15,255	50%	14,067	55%
Students in Poverty	13,907	45%	11,165	44%
Special Education Students	4,515	15%	3,014	12%
English Language Learners	638	2%	267	1%
Grade Repeating Students	670	2%	47	0%

NOTE: The appendix includes additional descriptive demographics.

For this analysis, a total of 25,473 charter school students (with 50,553 observations across 5 growth periods) are followed for as many years as data are available.[5] The students are drawn from Grades 3 – 8, since these are the continuous grades that are covered by the state achievement testing program for reading and math. Students are also drawn from 10th grade if an 8th grade record is present to enable calculation of student growth[6]. An identical number of virtual comparison records are included in the analysis. In Massachusetts, it was possible to create virtual matches for 83 percent of the tested charter school students in both reading and math. This proportion assures that the results reported here can be considered indicative of the overall performance of charter schools in the state. However, we were only able to find matches for 42% of English Language Learners, reducing confidence that results from our sample can be generalized to the population as a whole. The total number of observations is large enough to be confident that the tests of effect will be sensitive enough to detect real differences between charter school and TPS student performance at the statistically acceptable standard of $p<.05$. This is also true for each student subgroup examined, with the exception of grade-repeating students, as can be seen in Table 2 above.

A Roadmap to the Graphics

The graphics in this report have a common format.

Each graph presents the average performance of charter students relative to their **pertinent comparison student**. The reference group differs depending on the specific comparison. Where a graph compares student subgroup performance, the pertinent comparison student is the same for both subgroups. Each graph is labeled with the pertinent comparison group for clarity.

The **height** of the bars in each graph reflects the magnitude of difference between traditional public school and charter school performance over the period studied.

Stars are used to reflect the level of statistical significance of the difference between the group represented in the bar and its comparison group; the absence of stars means that the schooling effect is not statistically different from zero.

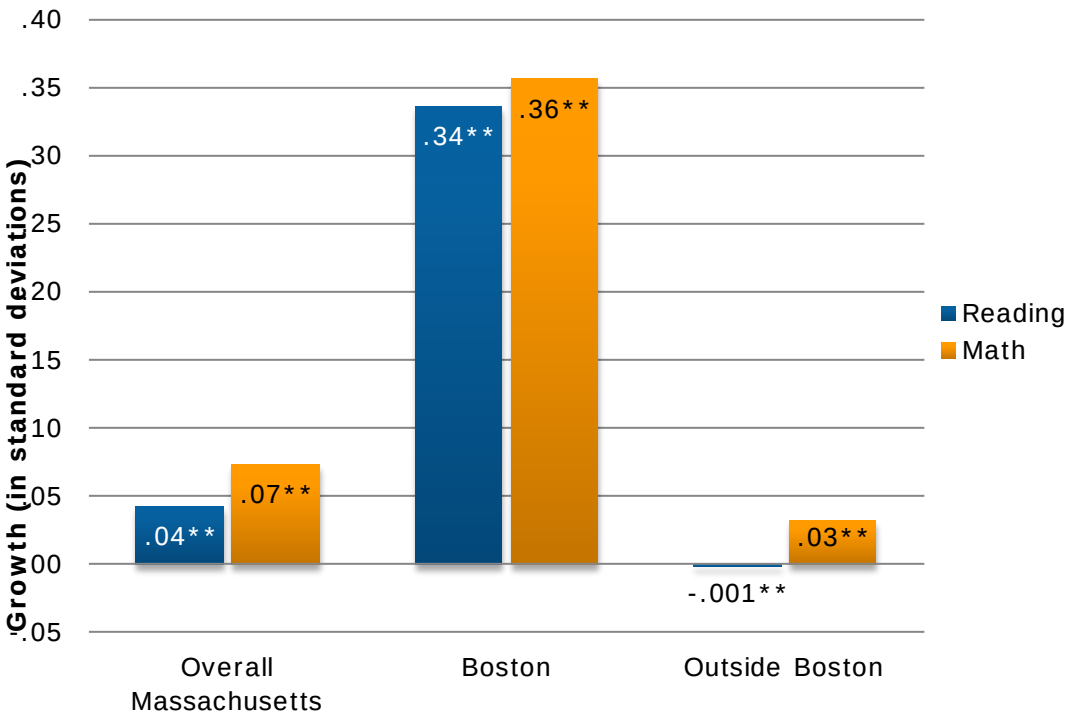
Comparisons of the **performance of similar student subgroups** contain an additional test of the absolute difference between the charter school subgroup and their comparison VCRs. Where a charter school student subgroup has learning gains that are statistically significantly different, the bars have a gradient shade.

[5] Schools that have opened recently or that have only recently begun serving tested grades will not have five growth periods of experience to include.
[6] Growth for 10th grade students is calculated by subtracting their 8th grade z-score from their 10th grade z-score and dividing by two.

Overall Charter School Impact

First, we examine whether charter schools differ overall from traditional public schools in how much their students learn, holding other factors constant. To answer this question, we average the pooled performance for all charter school students across all the growth periods and compare it with the same pooled performance of the VCRs. The result is a measure of the typical learning of charter school students in one year compared to their comparison VCR peers from the feeder schools nearby. The results appear in Figure 3. On average, students in Massachusetts's charter schools learned significantly more than their virtual counterparts in reading and mathematics.

Figure 3: Average Learning Gains in Massachusetts Charter Schools, 2007-2011 Compared to Gains for VCR Students in Each Charter Schools' Feeder TPS



*** Significant at p ≤ 0.05 ** Significant at p ≤ 0.01**

When we investigate the learning impacts of Boston charter schools separately, we find that their results are significantly larger in reading and math than both the overall state results and the results for charter schools outside of Boston. In fact, it appears as though the larger average charter growth in reading is entirely driven by

the growth of Boston charter schools. The average math and reading growth found in Boston's charter schools is the largest state or city level impact CREDO has identified thus far. Given the magnitude of the effect sizes found for Boston's charter schools, the performance trend of Boston's TPS's was analyzed. This is because, given that the average effect size is determined by comparing the growth of charter students to their peers at TPS, if performance among TPS students was falling dramatically this would partially explain the gap in performance. However, the performance of students enrolled in Boston's TPS remained generally stable over the sample period, suggesting that the positive charter effect is largely driven by high growth in the charter sector, not falling performance among Boston's TPS.

The data is analyzed in units of standard deviations of growth so that the results will be statistically correct. Unfortunately, these units do not have much meaning for the average reader. Transforming the results into more accessible units is challenging and can be done only imprecisely. Therefore, Table 3 below, which presents a translation of various outcomes, should be interpreted cautiously.[7]

Table 3: Transformation of Average Learning Gains

Growth (in standard deviations)	Gain (in months of learning)
0.00	0.0
0.05	1.8
0.10	3.6
0.15	5.4
0.20	7.2
0.25	9.0
0.30	10.8
0.35	12.6

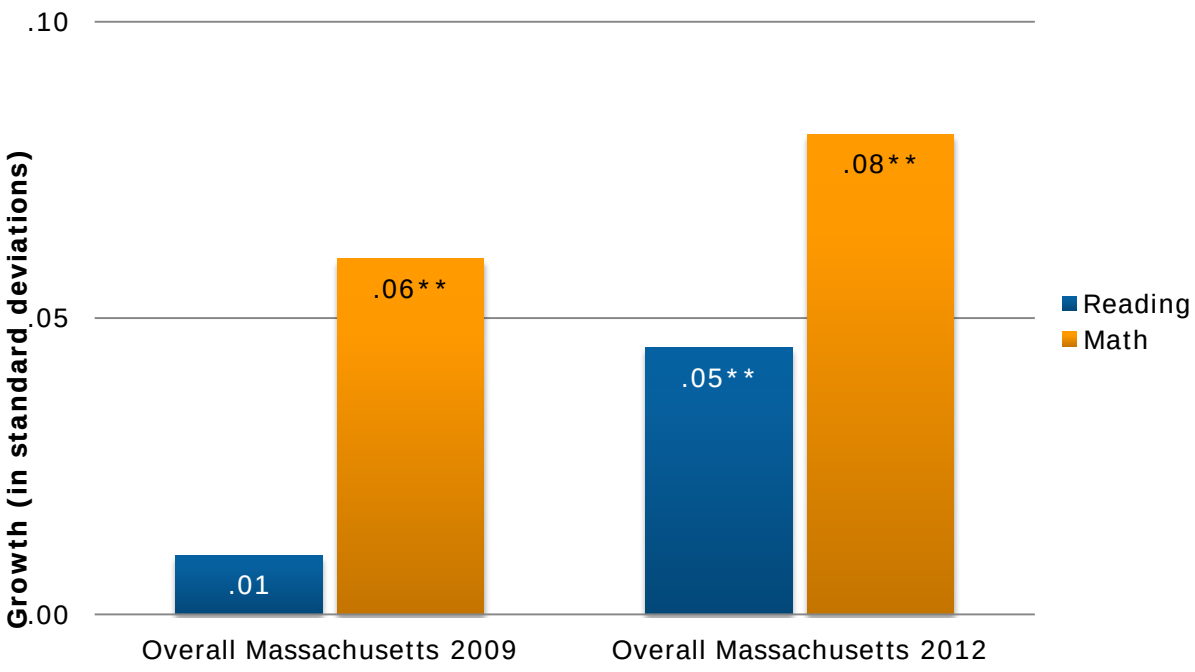
Using the results from Figure 3 and the transformations from Table 3, per year of schooling, we can see that, on average, charter students in Massachusetts gain an additional one and a half months of learning in reading over their TPS counterparts. In math, the advantage for charter students is about two and a half months of additional learning in one school year. Charter students in Boston gain an additional 12 months in reading and 13 months in math per school year compared to their TPS counterparts.

[7] Hanushek, Eric A. and Steven G. Rivkin. Teacher quality. In *Handbook of the Economics of Education*, Vol. 2, ed. EA Hanushek, F Welch, (2006): 1051–1078. Amsterdam: North Holland.

Charter School Impact with 2009 Cohort

Because the charter school market is dynamic, new schools have opened since the previous report. To create an apples-to-apples comparison between the two reports, the subset of schools from the 2009 state report were re-analyzed using only data released since the previous report.[8] Both these and the 2009 results are shown in Figure 4.

Figure 4: Original and Updated Impacts with the 2009 Charter School Cohort



*** Significant at p ≤ 0.05 ** Significant at p ≤ 0.01**

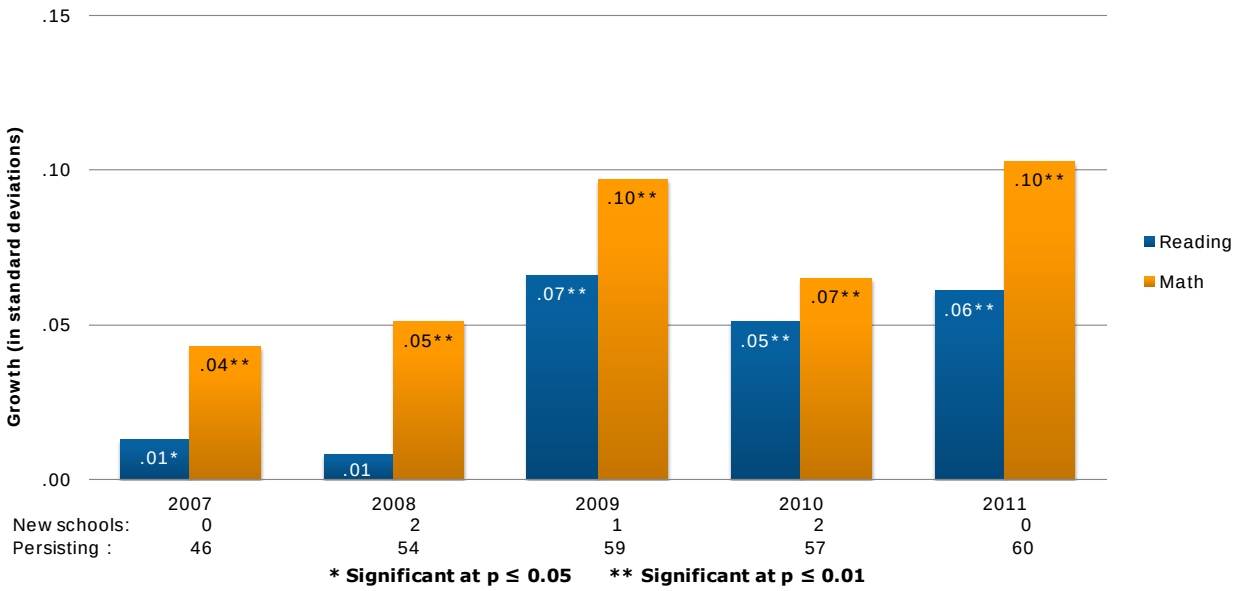
In the previous report, students from the 2009 charter school cohort learned significantly more than their TPS counterparts in math but had no advantage in reading. Charter students at these same schools in more recent growth periods learn significantly more than their TPS peers in both reading and math. The updated effect sizes are also larger than those from the first report in reading and are slightly larger in math.

[8] The original Massachusetts report included data from the 2004-2005 school year to the 2006-2007 school year.

Charter School Impact by Growth Period

To determine whether performance remained consistent over all the periods of this study, the average charter school effects were disaggregated into the five growth periods. Results are shown in Figure 5 along with the number of newly opened and persisting schools for each growth period.

Figure 5: Impact by Growth Period, 2007-2011[9]



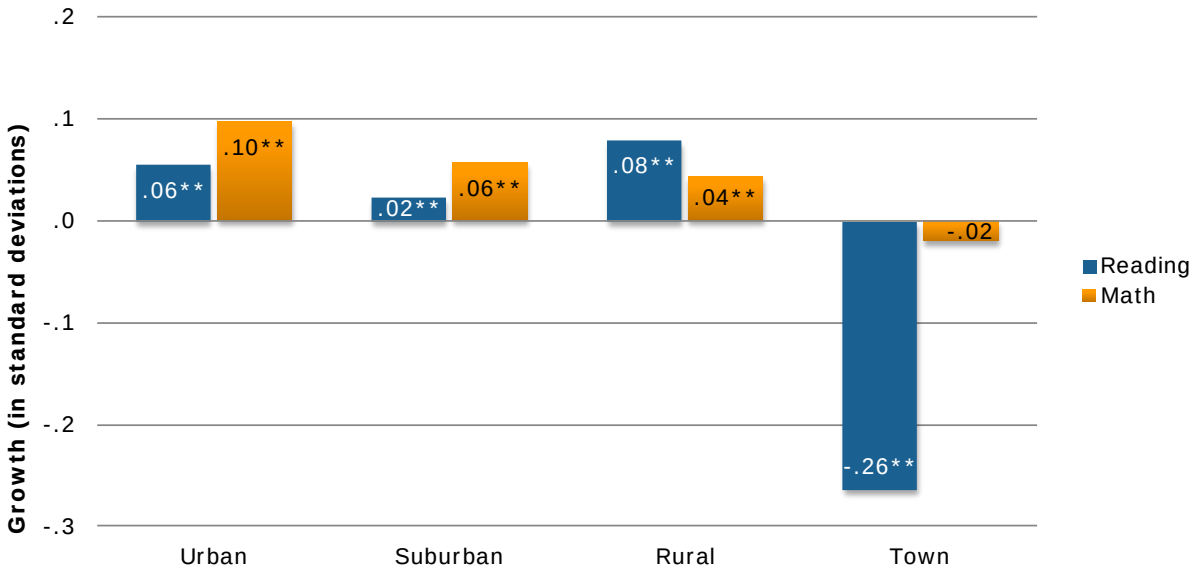
In reading, charter students in Massachusetts learned significantly more than their virtual peers in four of the five periods analyzed. In 2008, the charter impact on reading was positive but not significant. The results were positive and significant for all five periods in math. In both reading and math, the lowest charter school impacts are found in 2007 and 2008, and generally increase in later years. Disaggregating the impacts into new and persisting schools revealed that persisting charter schools have larger positive impacts on both math and reading growth than new charters.

[9] Note: These numbers report only charters with tested students, so they are a subset of the counts on Figure 2, Opened and Closed Charter Campuses. There also may be a lag between a school's opening and their students reaching grades with standardized testing.

Charter School Impact by Location

Although charter schools in urban areas receive the bulk of media attention, charter schools can and do choose to serve in other locales. Differences in location may relate to different average charter school effects. The results in Figure 6 represent the disaggregated impacts for urban, suburban and rural charter schools.

Figure 6: Impact by School Location



*** Significant at p ≤ 0.05 ** Significant at p ≤ 0.01**

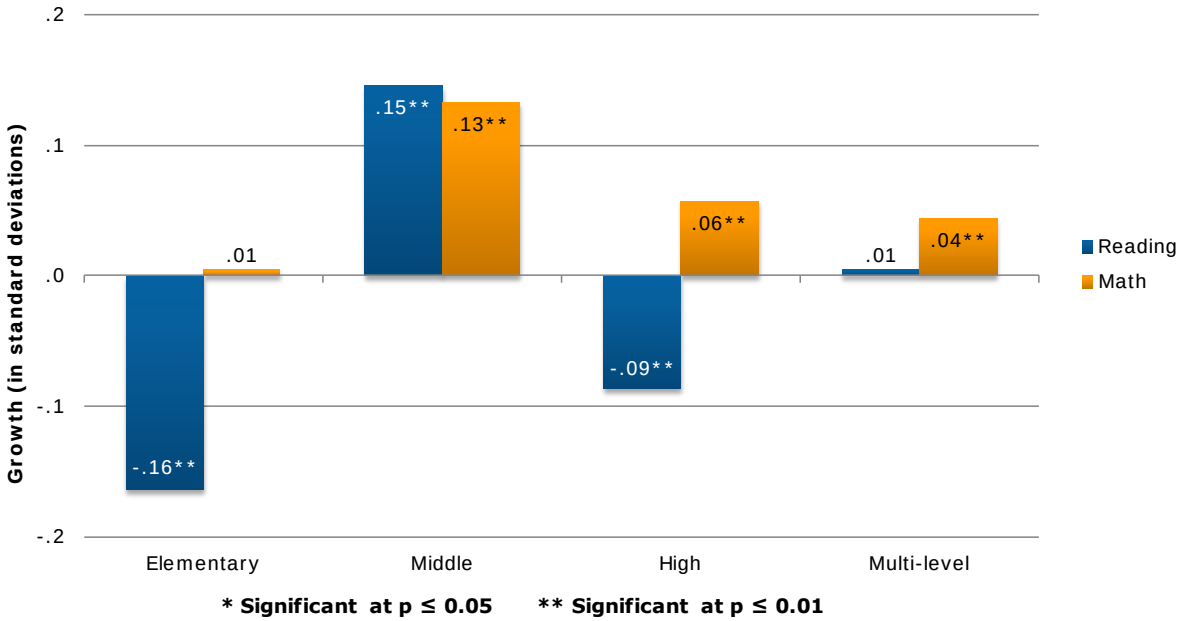
Students enrolled in urban charter schools in Massachusetts learn significantly more in both math and reading compared to their peers in TPS. This is also true for students in suburban charter schools, although the impact is not as large. Students in rural charter schools see the largest gains in reading and the smallest gains in math among the locations with positive average effects. Charter schools located in areas designated "towns" by the National Center for Education Statistics see significantly lower growth in reading and similar growth in math compared to their TPS counterparts.

Charter School Impact by School Level

The flexibility and autonomy enjoyed by charter schools allows them to choose which grade levels to serve, with many charter operators deciding to focus on particular ages while others seek to serve a broader range of students. For example, multi-level charter schools serve grade ranges larger than traditional elementary, middle or high schools, such as a combination of middle and high school grades. These school levels are tracked by the National Center for Education Statistics, which allows us to disaggregate charter school impacts for different grade spans.

This study examined the outcomes of students enrolled in elementary, middle, high and multi-level schools. Growth scores for high schools display one half of the growth between 8th grade and 10th grade (an estimate of the growth between 9th and 10th grade), since testing data exists for only one grade level in high school. The results appear in Figure 7 below.

Figure 7: Impact by School Level



*** Significant at p ≤ 0.05 ** Significant at p ≤ 0.01**

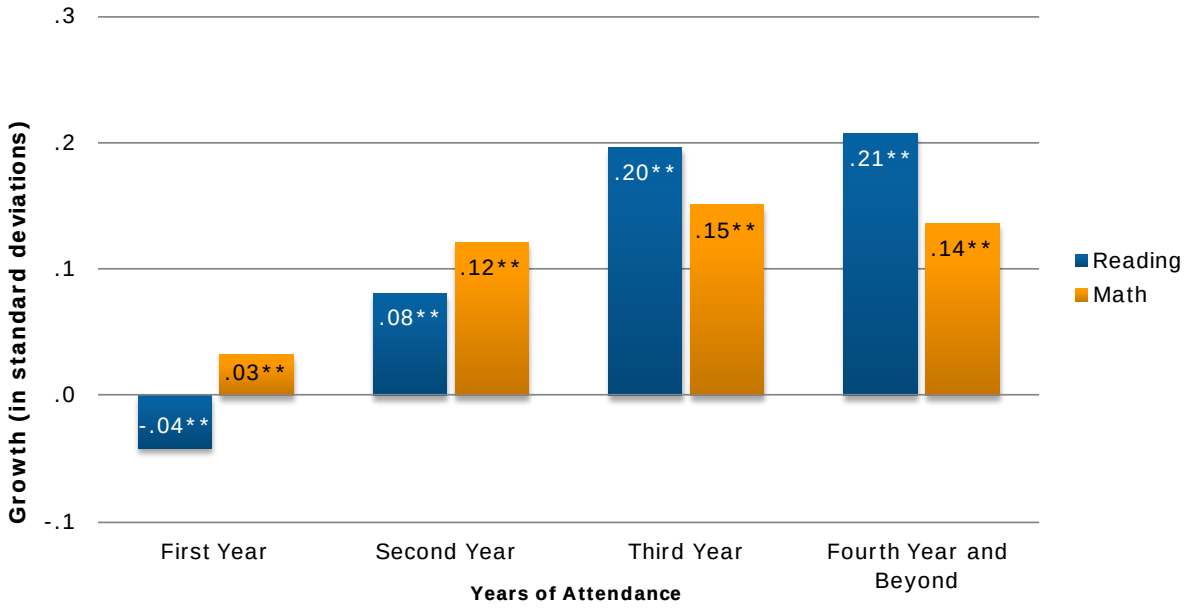
Charter middle schools appear to be driving much of the overall positive results found across the state, particularly in reading growth. The results show that, on average, charter middle school students learn significantly more than their virtual counterparts in both reading math. Charter students enrolled in high and multi-level schools also have higher growth in math, while those enrolled in elementary

charter schools have similar growth. Students enrolled in elementary charter and high schools have significantly lower growth in reading than their TPS peers.

Charter School Impact by Students' Years of Enrollment

Student growth in charter schools may change as students continue their enrollment over time. To test this, students were grouped by the number of consecutive years they were enrolled in charter schools. In this scenario, the analysis is limited to the charter students who enrolled for the first time in a charter school between 2006-2007 and 2010-2011. Although the number of students included will be smaller, it is the only way to make sure that the available test results align with the years of enrollment. For this reason, the results of this analysis should not be contrasted with other findings in this report. This question examines whether the academic success of students who enroll in a charter school changes as they continue their enrollment in a charter school. The results are shown below in Figure 8.

Figure 8: Impact by Students' Years of Enrollment



*** Significant at p ≤ 0.05 ** Significant at p ≤ 0.01**

The results suggest that new charter school students see initial gains in math and losses in reading compared to their counterparts in traditional public schools. In the second, third and fourth years of attendance, large and significant gains in learning compared to students in TPS are observed in both reading and math.

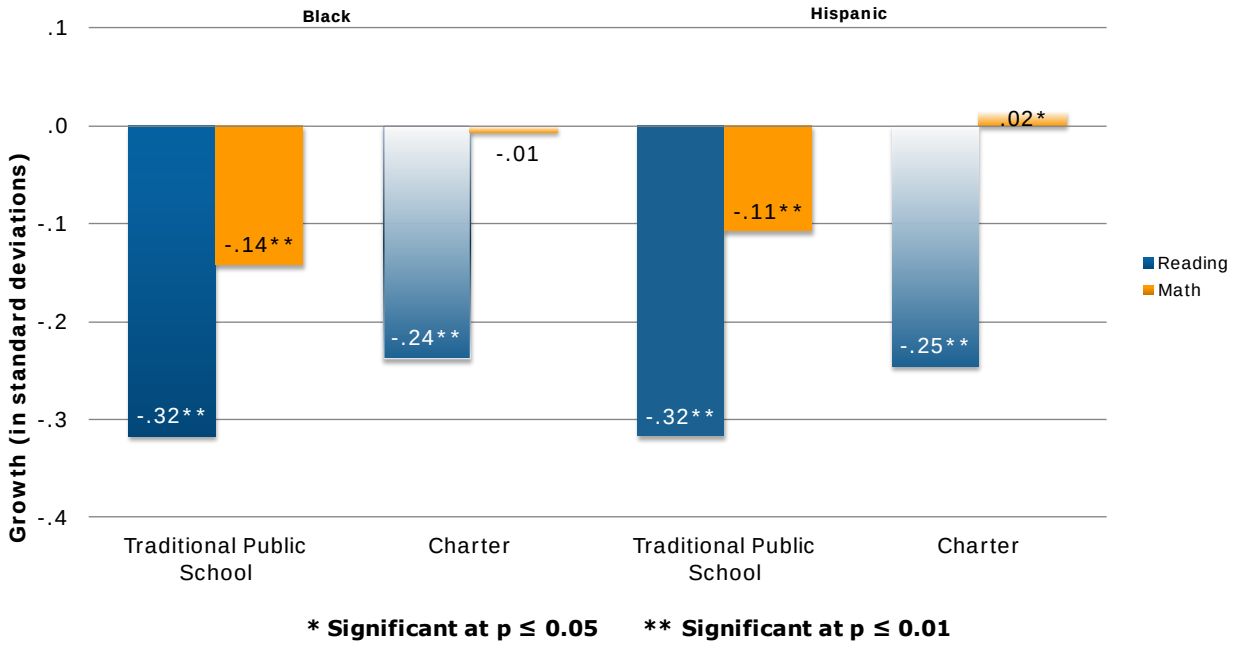
Charter School Impact by Race/Ethnicity

Attention in US public education to achievement differences by racial and ethnic backgrounds has increased since the passage of the *No Child Left Behind* Act in 2001. The effectiveness of charter schools across ethnic and racial groups is especially important given the proportion of charter schools that are focused on educating historically underserved students. The impact of charter schools on the academic gains of Black and Hispanic students is presented in Figure 9 below.

The graph displays two distinct comparisons, described below:

- The first comparison displays the performance of TPS students in the subgroups of interest relative to the "average white student in TPS;" in this comparison, the white student does not qualify for subsidized school meals, Special Education services or English Language Learner support and is not repeating a grade. The values that appear in each vertical bar indicate the magnitude of difference from this comparison student, and the stars indicate the level of statistical significance. Thus, if there is no difference in the learning gains, the bar would be missing entirely; if the learning of the student group in question is not as great as the comparison baseline, the bar is negative and if the learning gains exceed the comparison, the bar is positive.
- A second comparison tests whether the learning gains in the charter school student subgroup differs significantly from their peers in the same student subgroup in their feeder TPS. Where the difference is significant, the charter school bar has gradient shading.

Figure 9: Impact with Black and Hispanic Students



*** Significant at p ≤ 0.05 ** Significant at p ≤ 0.01**

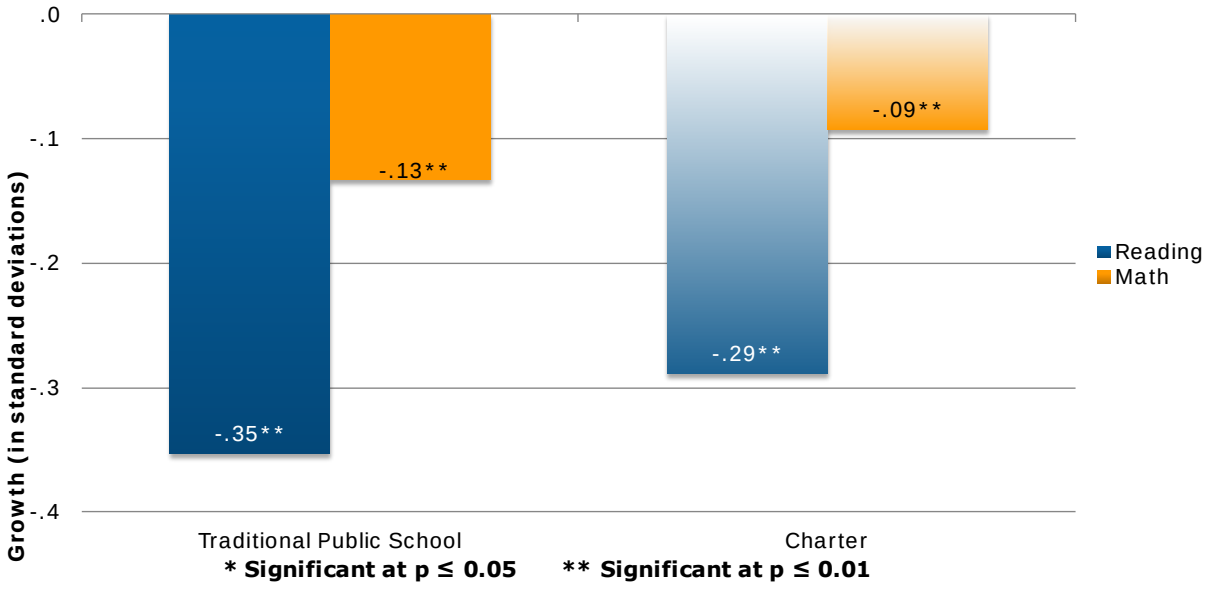
On average, Black and Hispanic students in both TPS and charter schools have significantly smaller learning gains in reading than those of average white students in TPS, the baseline of comparison. However, Black and Hispanic students enrolled in charter schools show significantly better performance in reading compared to their counterparts in TPS, designated by the frosted bars.

Black and Hispanic students in TPS have significantly smaller learning gains in math than those of white students in TPS, the baseline of comparison. However, Black students in charter schools perform similarly to white students in TPS and significantly better than black students in TPS. Hispanic students in charter schools have significantly higher growth than both white and Hispanic students in TPS.

Charter School Impact with Students in Poverty

Much of the motivation for developing charter schools aims at improving education outcomes for students in poverty. The enrollment profiles of charter schools across the country underscore this fact; in Massachusetts, 47 percent of charter students are eligible for subsidized school meals, a proxy for low income households. Thus, the impact of charter schools on the learning of students in poverty is important in terms of student outcomes and as a test of the commitment of charter school leaders and teachers to address the needs of this population. Figure 10 presents the results for students in poverty. In this graph, the comparison student is a student who pays full price for school meals in TPS, a proxy for not being in poverty.

Figure 10: Impact with Students in Poverty

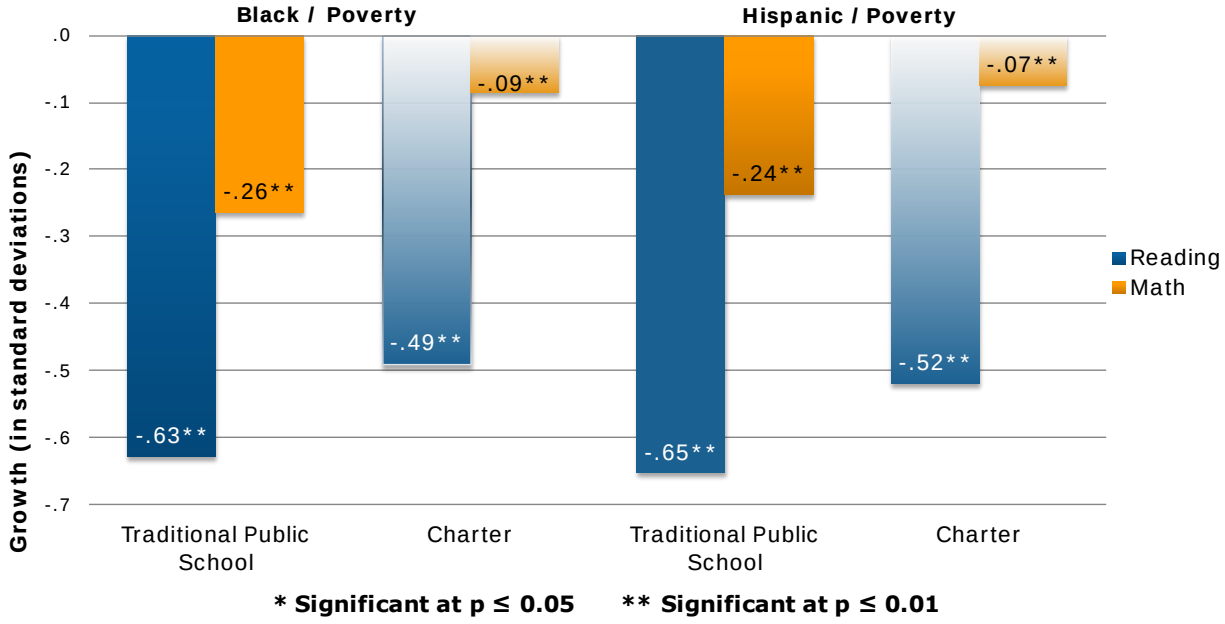


As shown in the figure above, in Massachusetts, students in poverty perform significantly worse than their non-poverty peers regardless of whether they attend a TPS or a charter. However, students in poverty who are enrolled in charter schools perform significantly better in both reading and math compared to students in poverty in TPS.

Charter School Impact with Race/Ethnicity and Poverty

The most academically needy students in public education are those who are both living in poverty and are a racial or ethnic minority that has been historically underserved. These students represent the most challenging subgroup, and their case has been the focus of decades of attention. Within the national charter school community, this group receives special attention. The impact of charter schools on the academic gains of Black students living in poverty and Hispanic students living in poverty is presented in Figure 11 below.

Figure 11: Impact with Black and Hispanic Students in Poverty



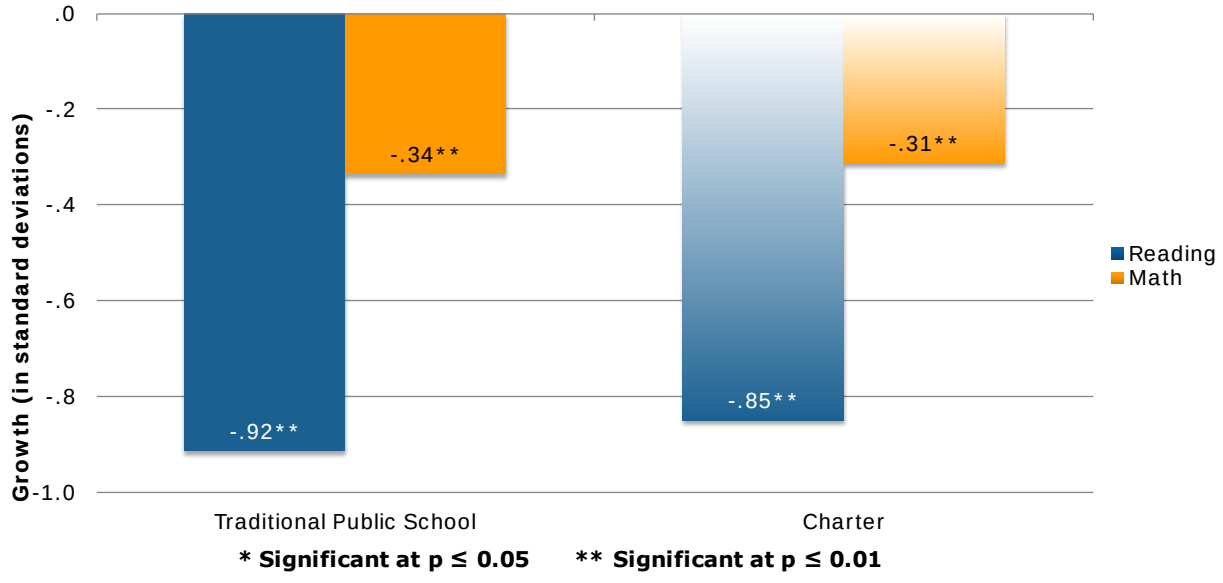
Black and Hispanic students in poverty in both TPS and charter schools have smaller gains in reading and math than those of the average non-poverty white TPS student, the baseline of comparison. However, Black and Hispanic students in poverty who are enrolled in charter schools show significantly better performance in reading and math than their counterparts in poverty in TPS.

Charter School Impact with Special Education Students

The demographic comparisons in the CREDO national charter school report released in 2009 indicated that across the charter sector, schools serve fewer Special Education students than the traditional public schools both in number of students and as a proportion of their enrollment. In some cases, this is a deliberate and coordinated response with local districts, based on a balance of meeting the needs of the students and a consideration of cost-effective strategies for doing so. In Massachusetts, the overall proportion of charter school students who are Special Education is 12 percent, compared to 16 percent in TPS statewide and 17 percent in the charter schools' feeder schools. Anecdotal evidence suggests that TPS and charters may differ in their criteria for designating students as needing to be assessed for special education services; this topic has been flagged for future study on student enrollments.

It is especially difficult to compare the outcomes of Special Education students, regardless of where they enroll. The most serious challenge rests on the small numbers of Special Education students. Consequently, there is tremendous variation when all categories are aggregated, a necessary and messy requirement for comparison purposes. Of all the facets of the current study, this one deserves the greatest degree of skepticism. With this cautionary note, the results are presented in Figure 12 below.

Figure 12: Impact with Special Education Students



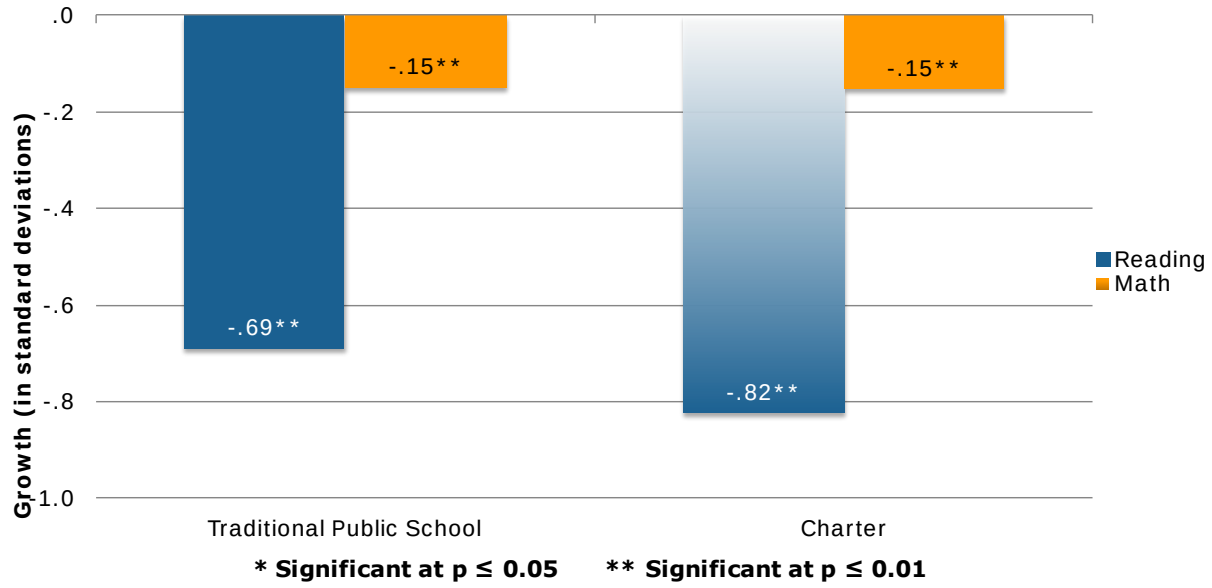
Special Education students enrolled in both TPS and charter schools perform significantly worse than students not receiving special education services. However, Special Education students in charter schools see significantly larger growth than their counterparts in TPS in reading and math.

Charter School Impact with English Language Learners

Students who enroll in school without sufficient English proficiency represent a growing share of public school students. Their success in school today will greatly influence their success in the world a decade from now. Since their performance as reflected by National Assessment of Education Progress lags well behind that of their English proficient peers, their learning gains are a matter of increasing focus and concern nationally and in Massachusetts.

The comparison of learning gains of charter school English Language Learners and their TPS counterparts appears in Figure 13. The baseline of comparison is the typical learning gain of the comparison peers in traditional public schools who are proficient in English.

Figure 13: Impact with English Language Learners



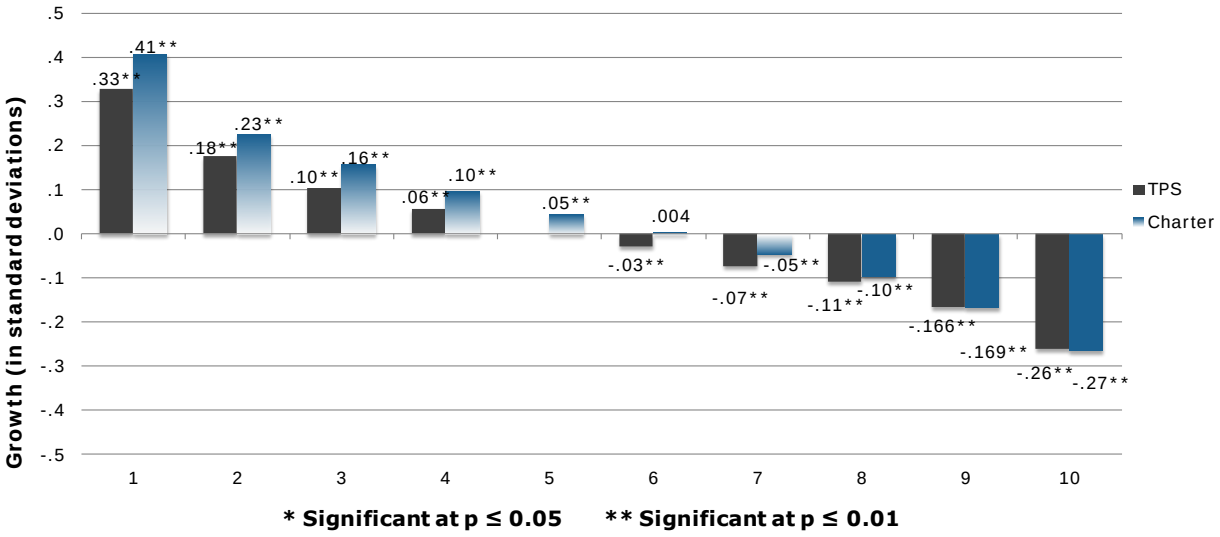
English Language Learner students in both TPS and charter schools learn significantly less per year than native/fluent English speakers in reading and math. Looking at the results between the sectors, English Language Learners have similar learning gains in math whether they attend a TPS or a charter, but those enrolled in charter schools have significantly lower learning gains in reading than their TPS counterparts.

Charter School Impact by Student's Starting Decile

A general tenet of charter schools is a commitment to the education and development of every child. Further, many charter schools, including several in Massachusetts, have as part of their mission a specific emphasis on serving students who have not thrived academically in TPS and whose early performance is well below average. We examined the performance of charter schools to see if they produced equivalent results across the spectrum of student starting points and in relation to the results observed for equivalent students in TPS.

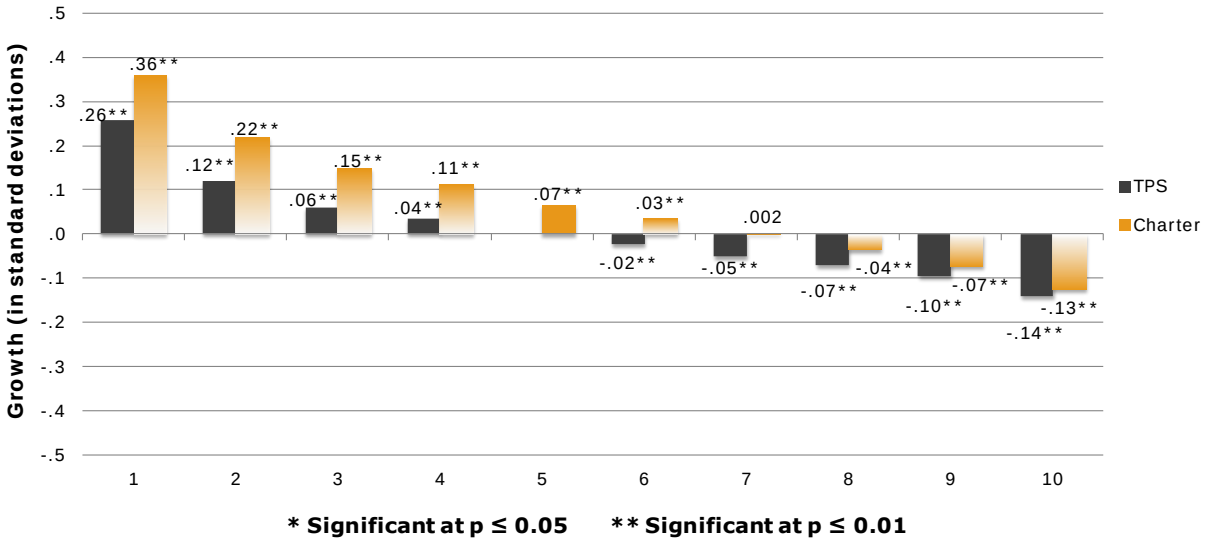
To do this, for charter school students and their VCRs, their baseline achievement test scores in reading and math were disaggregated into deciles. In this analysis, the base of comparison is the average academic growth of the TPS students in Decile 5, which corresponds to students in the 50th to 60th percentiles in the state. Student achievement growth in each decile for charter school students and their VCRs was then compared. The results appear in Figures 14 and 15 below.

Figure 14: Impact by Students' Starting Decile – Reading



*** Significant at p ≤ 0.05 ** Significant at p ≤ 0.01**

Figure 15: Impact by Students' Starting Decile – Math



*** Significant at p ≤ 0.05 ** Significant at p ≤ 0.01**

Both figures demonstrate the expected "S"-shaped curve to the results. The overall curve reflects the typical pattern of larger learning gains for students with lower prior scores and larger learning losses for students with higher starting scores, a phenomenon known as "regression to the mean." Here, the relative magnitudes are important: Do charter schools produce relatively better growth results than TPS? If so, the charter curve would have larger gains on the low end and smaller losses on the high end of the distribution.

For students in Massachusetts, Figures 15 and 16 show that charter schools generally do better than TPS in the lower and middle deciles in both reading and math. In the upper three deciles, the performance of charter schools in reading is equivalent to the gains produced in TPS for these high achieving students, while charters retain their advantage in math in the upper deciles of performance.

School–level Analysis

Comparative School-level Quality While the numbers reported above represent the average learning gains for charter school students across the state, the pooled average effects tell only part of the story. Parents and policymakers are also interested in school-level performance. In order to determine the current distribution of charter school performance, the average effect of charter schools on student learning over the two most recent growth periods (2010 and 2011) is compared to the experience the students would have realized in their local traditional public schools. [10] The performance of the VCR students associated with each charter school comprises this measure of the local educational market. This analysis provides an average contribution to student learning gains for each charter school. This measure is called the school's effect size; as for the overall and by-year impacts, it is expressed in standard deviations of growth.

As noted in Table 1, charter schools are slightly smaller on average than their corresponding feeder schools. In addition, some charter schools elect to open with a single grade and mature one grade at a time. Consequently, care is needed when making school-level comparisons to ensure that the number of tested students in a school is sufficient to provide a fair test of the school impact. Our criteria for inclusion was at least 60 matched charter student

A Note about Tables 5 and 6

There are four quadrants in each table. We have expanded on the usual quadrant analysis by dividing each quadrant into four sections. The value in each box is the percentage of charter schools with the corresponding combination of growth and achievement. These percentages are generated from the 2010 and 2011 periods.

The uppermost box on the left denotes the percentage of charters with very low average growth but very high average achievement. The box in the bottom left corner is for low-growth, low-achieving schools.

Similarly, the topmost box on the right contains the percentage of charters with very high average growth and very high average achievement, while the bottom right corner contains high-growth, low-achieving schools.

The major quadrants were delineated using national charter school data. We would expect about 46% of schools to have an effect size between -0.15 and 0.15 standard deviations of growth (the two middle columns). Similarly, we would expect about 50% of schools to achieve between the 30th and 70th percentiles. Therefore, if schools were randomly distributed, we would expect about 6% in any small square and about 25% of the schools to appear in the middle four squares.

[10] We chose to include only the two most recent growth periods in this analysis for two reasons. First, we wanted a highly relevant contemporary distribution of charter school performance. Second, using only two periods of data ensured that all schools' effect sizes were measured fairly; they are all based on one or two periods of data instead of one period for some schools and five periods for others.

records over the two years, or, for new schools with only one year of data, at least 30 matched charter records. Of our total sample of 62 schools with math and reading test scores in 2010 and 2011, 8 schools had an insufficient number of individual student records to calculate a representative school-wide average growth score. Table 4 below shows the breakout of performance for the Massachusetts charter schools that meet our criteria for inclusion by having a sufficient number of charter student records.

Table 4: Performance of Charter Schools Compared to Their Local Markets

	Significantly Worse		Not Significant		Significantly Better	
Subject	Number	Percent	Number	Percent	Number	Percent
Reading	7	13.0%	23	42.6%	24	44.4%
Math	9	16.7%	15	27.8%	30	55.6%

In reading, 44 percent of charter schools perform significantly better than their traditional public school market, while 56 percent perform significantly better in math. Both of these results are better than the national average proportion of better-performing charters (17%).[11] The lowest school effect size in reading was -0.37 standard deviations of growth, while the highest effect size was 0.44. The gap between the lowest and highest effect sizes was larger in math; they were -0.52 and 0.45, respectively. A larger proportion of charter schools were not significantly different from their market in reading than in math.

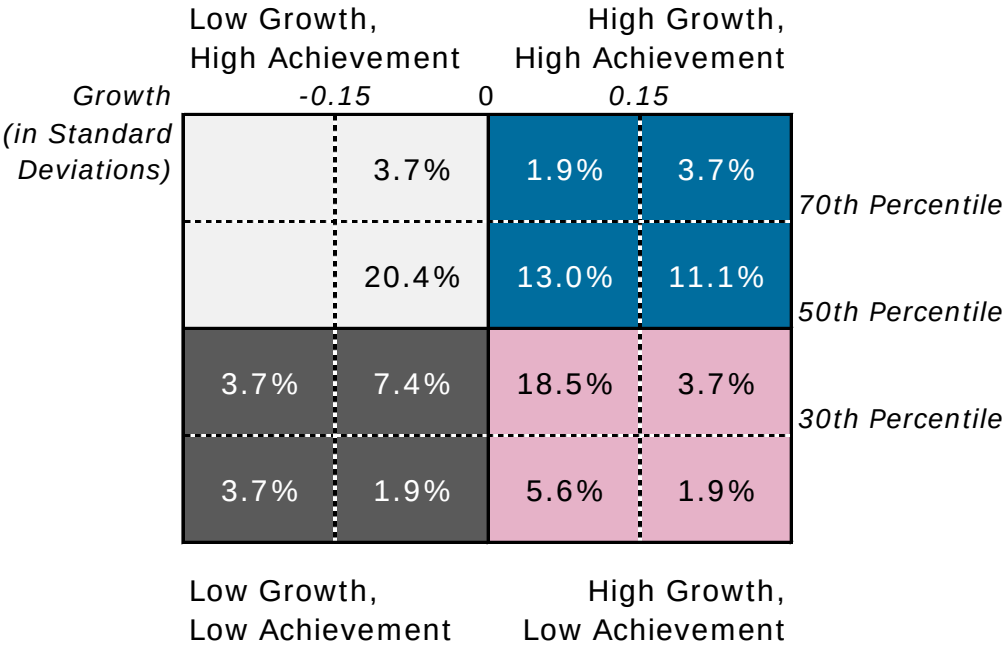
Impact of Growth on Achievement While the impacts of charter schools on academic growth relative to their local competitors is instructive, it is necessary to take a wide-angle view to determine how well these students are being prepared. Because many of the students served by charter schools start at low levels of achievement, it is vital to understand how well their academic growth advances them in absolute achievement. To do this, each school's average growth is placed in the context of their average achievement level compared to the rest of the state, as in Tables 5 and 6 below. For growth, we use the effect sizes discussed above. The school's average achievement level is the mean achievement of the students over the same two periods covered by the effect size (2010 and 2011).[12] The 50th percentile indicates statewide average performance for all public school students

[11] CREDO. *Multiple Choice: Charter School Performance in 16 States* (2009). http://credo.stanford.edu.

[12] Average achievement was computed using students' z-scores from the end of the growth period (e.g., spring 2010 and spring 2011), and the resulting school-level mean was then converted into a percentile.

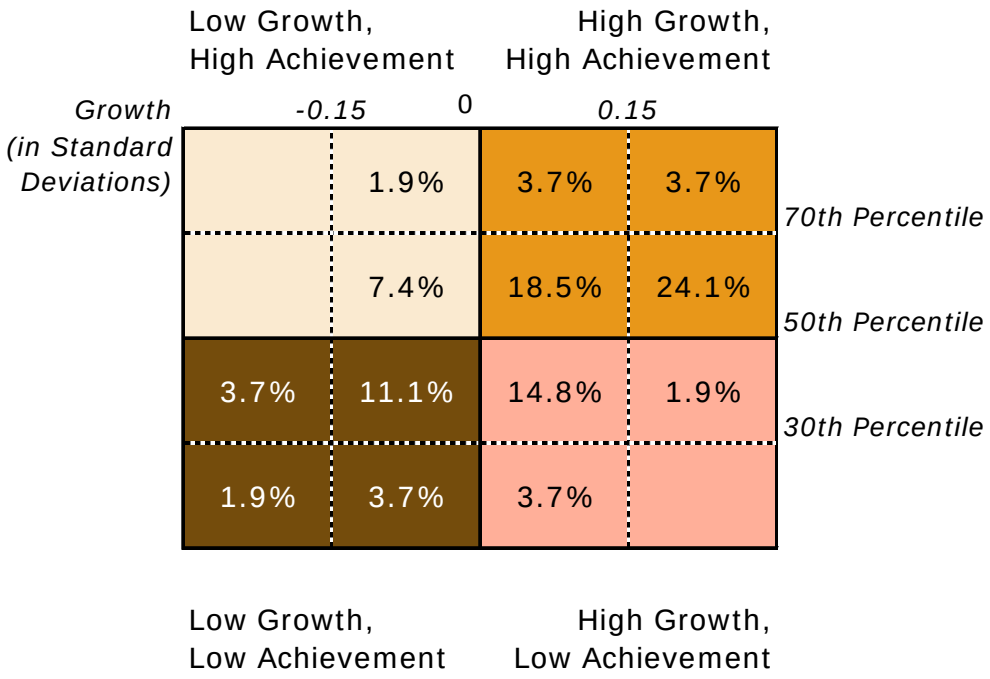
(traditional and charter). A school achievement level above the 50th percentile indicates that the school performs above the statewide average.

Table 5: Reading Growth and Achievement



In Massachusetts, 32 of the 54 charter schools (about 59 percent) had positive average growth in reading, regardless of their average achievement (this percentage is the sum of the squares in the blue and purple quadrants, the right half of the table). About 30 percent of charters had positive growth and average achievement above the 50th percentile of the state (i.e., the total for the blue quadrant on the top right). Roughly 46 percent of charters perform below the 50th percentile of achievement (the sum of the gray and purple in the lower portion of the table). Of concern is the nearly 17 percent of charters in the lower left gray quadrant, which represents low growth and low achievement, as well as the 24% of schools with above average achievement but below average growth.

Table 6: Math Growth and Achievement



For math, 38 of the 54 charter schools (70 percent) had positive average growth, as seen in the orange and pink quadrants. Fifty percent of charters had positive growth and average achievement above the 50th percentile (the top right, orange quadrant). Roughly 41 percent of charters have achievement results below the 50th percentile of the state (the sum of lower half of the table). Slightly more than 20 percent of Massachusetts charters have positive average growth but achievement below the 50th percentile in the state, as seen in the lower right, pink quadrant. If those schools continue their trends of growth above the state average, their absolute achievement would be expected to rise over time.

Boston

In this section we delve more deeply into charter school performance in Boston, where nearly 13 percent of Massachusetts charter students attend school. As with the earlier statewide graphs, each graph in this section displays two distinct comparisons:

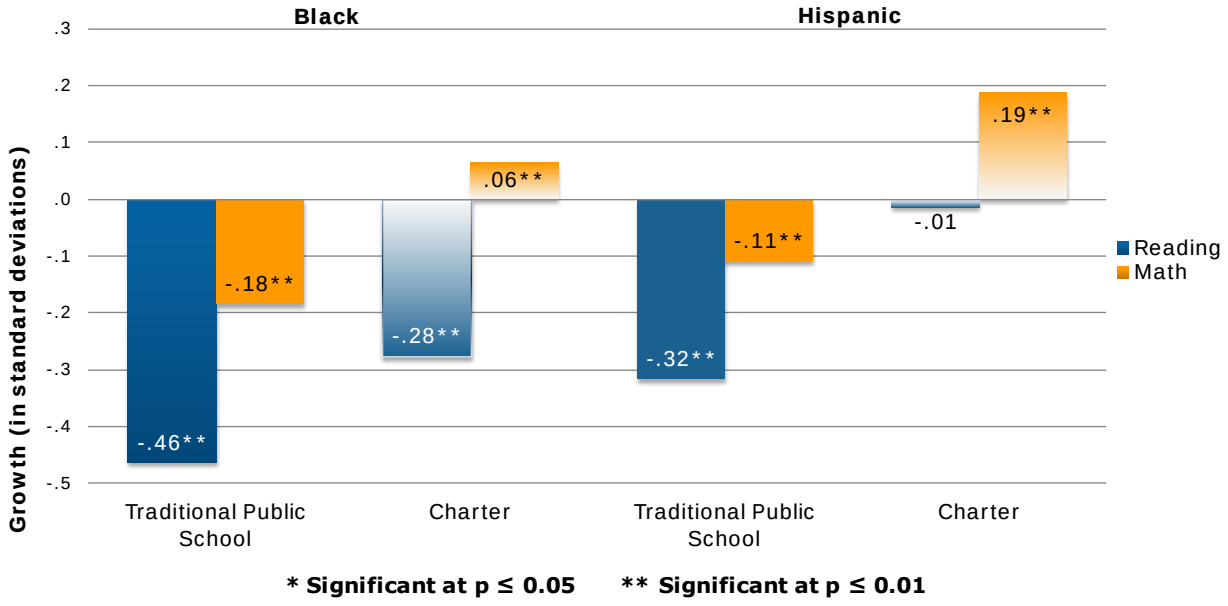
- The first comparison displays the performance of Boston TPS and charter students in the subgroup of interest relative to the "average statewide student in TPS." The values that appear in each vertical bar indicate the magnitude of difference from this comparison student, and the stars indicate the level of

statistical significance. Thus, if there is no difference in the learning gains, the bar would be missing entirely; if the learning of the Boston student group in question is not as great as the statewide comparison baseline, the bar is negative; and if the learning gains exceed the comparison, the bar is positive.

- A second comparison tests whether the learning gains in the Boston charter school student subgroup differs significantly from their peers in the same student subgroup in Boston traditional public schools. Where the difference is significant, the charter school bar has gradient shading.

Impact by Black and Hispanic Students Greater than 50 percent of tested Boston charter students are Black and about 33 percent are Hispanic, making these two historically underserved groups the majority student populations in the city's charter schools. The impact of charter schools on the academic gains for Black and Hispanic students in Boston are in Figure 16 below.

Figure 16: Impact by Black and Hispanic Students in Boston



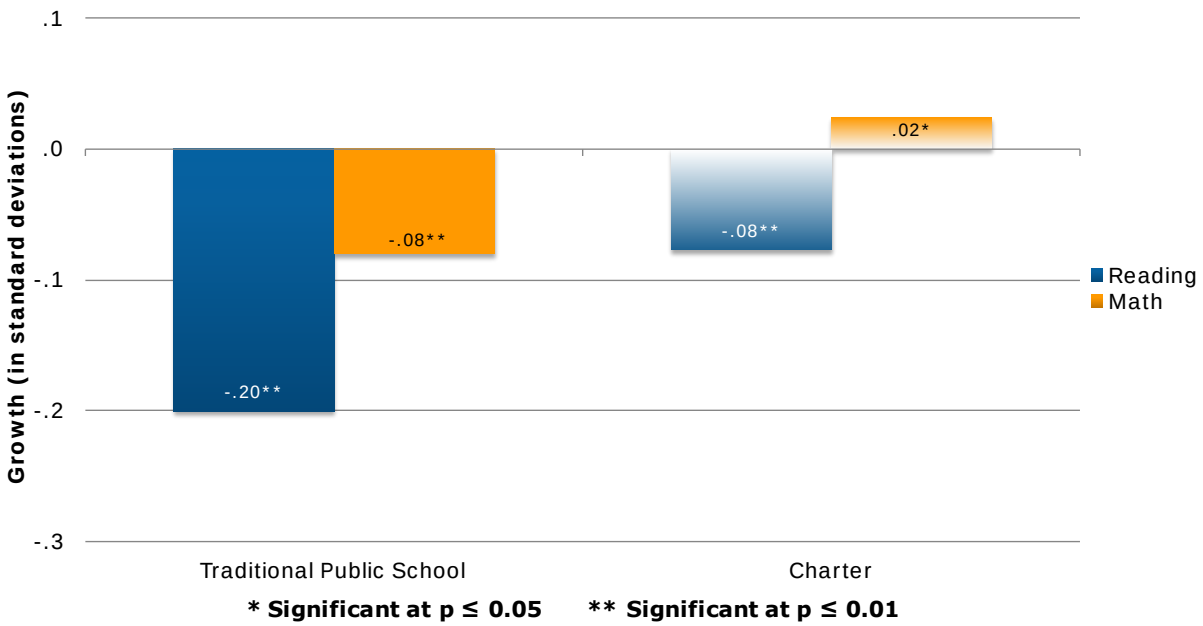
*** Significant at p ≤ 0.05 ** Significant at p ≤ 0.01**

Boston's Black students have smaller learning gains in reading than those of White students in traditional public schools, regardless of the type of school they attend. In both reading and math, Black students in Boston charter schools have significantly larger growth compared to Black students in Boston TPS. In fact, math growth for Black students in Boston charter schools is higher than that of White students enrolled at TPS.

Hispanic students in traditional public schools in Boston also have significantly lower rates of growth in reading and math than the average White student statewide in TPS. However, Hispanic charter students in Boston show significantly better outcomes in math and similar outcomes in reading compared to White students in TPS. Hispanic students in Boston charters also have larger growth than their peers in Boston TPS.

Impact by Students in Poverty In addition to Black and Hispanic students, another historically underserved group, students in poverty, comprises 74 percent of the Boston charter school population. Results for students in poverty are shown in Figure 17 below.

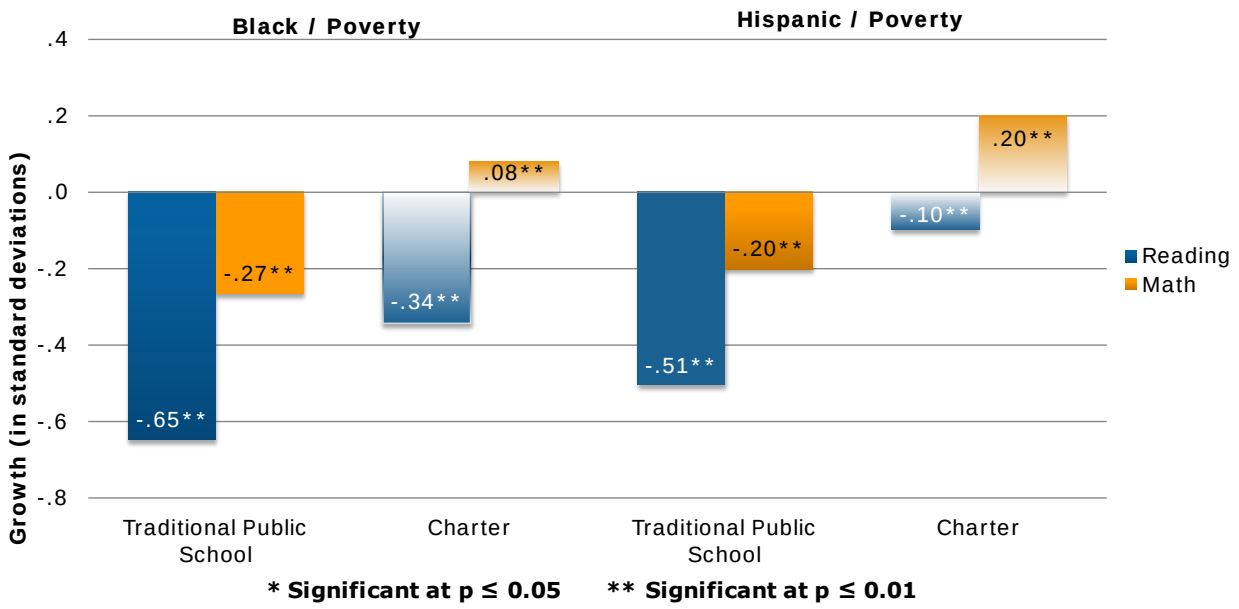
Figure 17: Impact by Students in Poverty in Boston



Boston charter students in poverty do significantly better than their TPS counterparts in reading and math compared to their TPS peers. Charter students in poverty in Boston also see higher growth in math than the statewide average growth rate for students not living in poverty.

Impact by Race/Ethnicity and Poverty In Boston, 41 percent of students are Black and living in poverty, while 28 percent are Hispanics living in poverty, making charter schools' impact with these students extremely important. The impact of Boston charter schools on the academic gains of Black and Hispanic students living in poverty living in poverty is presented in Figure 18 below.

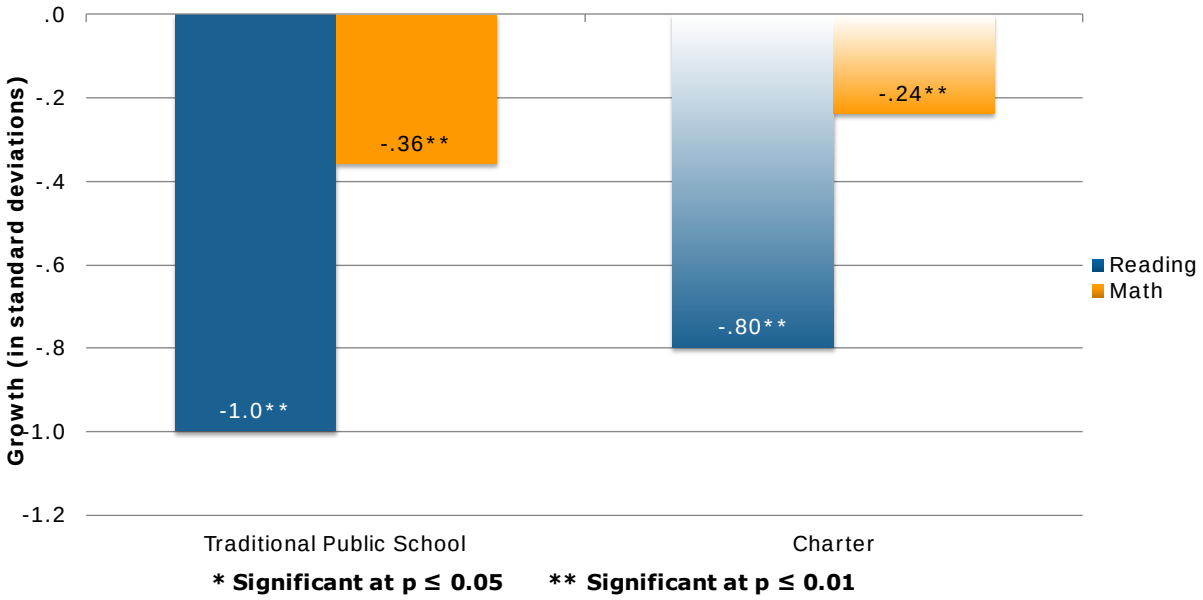
Figure 18: Impact by Boston Black and Hispanic Students in Poverty



Boston's Black and Hispanic students in poverty have smaller gains in reading than White TPS students statewide. This remains true whether students attend TPS or charter schools. However, both Black and Hispanic students in poverty enrolled in Boston charter schools show significantly better performance in reading compared to their peers in poverty in Boston TPS. With respect to math growth, Black and Hispanic students in poverty enrolled in Boston charters have significantly higher growth than both their peers in poverty in Boston TPS as well as White students in TPS across the state.

Impact on Special Education Students More than 10 percent of students in Boston charters receive special education services. As discussed in the section above reporting state wide results, it is difficult to compare the outcomes of Special Education students, due to relatively small numbers and the tremendous variation in disability categories. The results presented in Figure 19 below should be interpreted cautiously.

Figure 19: Impact with Special Education Students in Boston



Special education students in Boston charter schools progressed significantly more than their counterparts in Boston TPS in both reading and math. However, their growth was significantly weaker than that of the comparison group, TPS regular-education students. These results are in line with findings at the state level.

Comparative School-level Quality As with the statewide results, comparing charter school performance to the local traditional public school alternative in Boston can be an informative measure of quality. The results for Boston charter schools are shown in Table 7 below.

Table 7: Performance of Boston Charter Schools Compared to Local Markets

	Significantly Worse		Not Significant		Significantly Better	
Subject	Number	Percent	Number	Percent	Number	Percent
Reading	0	0.0%	2	16.7%	10	83.3%
Math	0	0.0%	2	16.7%	10	83.3%

In both reading and math, 83 percent of charter schools perform significantly better than their traditional public school market, which is significantly more positive than the percentages of Massachusetts charter schools outperforming TPS peers as a whole. Both of these results are dramatically better than the 2009 national study's

proportion of better-performing charters (17 percent).[13] Roughly 17 percent of charter schools were not significantly different from their market and none were found to be significantly worse than their TPS peers.

Synthesis and Conclusions

Based on the findings presented here, the typical student in Massachusetts charter schools gains more learning in a year than his TPS counterparts, amounting to about one and a half months of additional gains in reading and two and a half months in math. The advantage in learning in Boston charter schools equates to more than twelve months of additional learning in reading and thirteen months more progress in math. These outcomes are consistent with the result that charter schools have significantly better results than TPS for minority students who are in poverty.

A substantial share of Massachusetts charter schools appears to outpace TPS academic learning gain in both reading and math. Forty-four percent of Massachusetts charters outpace the learning impacts of TPS in reading, and 56 percent do so in math. Only a few of the schools included in the study have academic results that are significantly worse than their TPS counterparts; 13 percent of charter schools have results that are significantly worse than TPS for reading and 17 percent of schools for math.

The student-to-student and school-to-school results show charter schools to be performing well relative to the local alternatives. The larger question of whether charter schools are helping students achieve at high levels is also important. Nearly 17 percent of Massachusetts charter schools have below-average growth and below-average achievement in reading, and the same is true for 20 percent of the charter schools in math. Students in these schools will not only have inadequate progress in their overall achievement but will fall further and further behind their peers in the state over time.

The share of underperforming charter schools is offset, however, by the fact that the proportion of charter schools that are either already achieving at high levels or are positions to reach those levels. In both reading and math, a majority of charter schools have positive academic growth. For reading, the proportion is over 59 percent and for math it exceeds 70 percent. Should these trends continue, the share of schools that currently lag the state average for absolute achievement

[13] CREDO. *Multiple Choice: Charter School Performance in 16 States* (2009). http://credo.stanford.edu.

would be expected to decline. These absolute improvements are within sight in Massachusetts.

Table 8 presents a summary of the results.

Table 8: Summary of Statistically Significant Findings

	Reading	Math
Massachusetts Charter Students	Positive	Positive
Boston Charter Students	Positive	Positive
Charters in 2007	Positive	Positive
Charters in 2008		Positive
Charters in 2009	Positive	Positive
Charters in 2010	Positive	Positive
Charters in 2011	Positive	Positive
Urban Students	Positive	Positive
Suburban Students	Positive	Positive
Rural Students	Positive	Positive
Charter Schools Age 1 – 2 Years	Positive	
Charter Schools Age 3 – 4 Years		Positive
Charter Schools Age 5 – 6 Years	Positive	Positive
Charter Schools Age 7 – 8 Years	Positive	Positive
Charter Schools Age 9 or More Years	Positive	Positive
First Year Enrolled in Charter School	Negative	Positive
Second Year Enrolled in Charter School	Positive	Positive
Third Year Enrolled in Charter School	Positive	Positive
Fourth Year Enrolled in Charter School	Positive	Positive
Black Charter School Students	Positive	Positive
Hispanic Charter School Students	Positive	Positive
Charter School Students in Poverty	Positive	Positive
Black Charter School Students in Poverty	Positive	Positive
Hispanic Charter School Students in Poverty	Positive	Positive
English Language Learner Charter School Students	Negative	Negative
Special Education Charter School Students	Positive	Positive
Retained Charter Students		Positive
Boston Black Charter Students	Positive	Positive
Boston Hispanic Charter Students		Positive
Boston Charter Students in Poverty	Positive	Positive
Boston Black Charter Students in Poverty	Positive	Positive
Boston Hispanic Charter Students in Poverty	Positive	Positive

Appendix

The numbers in the tables below represent the number of charter observations associated with the corresponding results in the report. An equal number of VCRs were included in each analysis.

Appendix Table 1: Number of Observations for All Results

Student Group	Matched Charter Students	
	Reading	Math
Massachusetts Charter Students	49,240	51,865
Students in Boston	6,298	6,759
Students in Charters in 2007	7,735	8,548
Students in Charters in 2008	9,770	10,466
Students in Charters in 2009	10,402	10,765
Students in Charters in 2010	11,000	11,414
Students in Charters in 2011	10,333	10,672
Students in Urban Schools	23,046	24,524
Students in Suburban Schools	18,953	19,927
Students in Town Schools	666	699
Students in Rural Schools	6,472	6,599
Students in Elementary Schools	2,569	2,603
Students in Middle Schools	17,235	17,877
Students in High Schools	1,754	1,847
Students in Multi-level Schools	27,682	29,538
Students First Year Enrolled in Charter School	11,287	11,883
Students Second Year Enrolled in Charter School	5,826	6,195
Students Third Year Enrolled in Charter School	2,497	2,671
Students Fourth Year Enrolled in Charter School	582	656
Black Students	9,991	10,840
Hispanic Students	9,779	10,648
White Students	27,415	28,109
Students in Poverty	21,364	22,817
Black Students in Poverty	7,224	7,666
Hispanic Students in Poverty	7,996	8,614
Special Education Students	5,258	5,971
English Language Learners	337	487
Grade Repeating Students	111	170

Appendix Table 2: Number of Observations for All Results in Boston

Student Group	Matched Charter Students	
	Reading	Math
Boston Charter Students	6,298	6,759
Students in Charters in 2007	810	894
Students in Charters in 2008	1,247	1,371
Students in Charters in 2009	1,326	1,402
Students in Charters in 2010	1,616	1,719
Students in Charters in 2011	1,299	1,373
Students in Urban Schools	6,006	6,421
Students in Suburban Schools	292	338
Students in Elementary Schools	151	157
Students in Middle Schools	2,989	3,206
Students in High Schools	696	753
Students in Multi-level Schools	2,462	2,643
Students First Year Enrolled in Charter School	1,848	1,996
Students Second Year Enrolled in Charter School	859	928
Students Third Year Enrolled in Charter School	509	550
Students Fourth Year Enrolled in Charter School	87	104
Boston Black Students	3,319	3,526
Boston Hispanic Students	2,050	2,244
Boston White Students	877	922
Boston Students in Poverty	4,647	4,913
Boston Black Students in Poverty	2,571	2,678
Boston Hispanic Students in Poverty	1,778	1,901
Boston Special Education Students	608	776
Boston English Language Learners	51	62
Boston Grade Repeating Students	32	58

Appendix Table 3: Starting Deciles in Massachusetts

Student Group	Matched Charter Students	
	Reading	Math
Students in Decile 1	4,046	5,705
Students in Decile 2	3,491	4,418
Students in Decile 3	3,673	4,294
Students in Decile 4	4,455	4,507
Students in Decile 5	4,982	4,276
Students in Decile 6	5,792	5,130
Students in Decile 7	6,747	6,095
Students in Decile 8	8,059	7,510
Students in Decile 9	6,646	7,907
Students in Decile 10	1,349	2,023

Appendix Table 4: Demographic Composition of Charter Students in Greater Boston

Student Group	All Charter Students Tested		Matched Charter Students	
	Number	Percent	Number	Percent
Boston Charter Students	5,258		3,524	
% Matched	3,524	67%		
Black Students	2,761	53%	1,888	54%
Hispanic Students	1,720	33%	1,126	32%
White Students	655	12%	472	13%
Students in Poverty	3,642	69%	2,574	73%
Special Education Students	801	15%	391	11%
English Language Learners	125	2%	41	1%
Grade Repeating Students	188	4%	11	0%